Factors affecting the diagnosis of peripheral vascular disease before vascular surgery referral

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Objective: Many new patients evaluated by vascular surgeons are referred by internal medicine physicians (IMPs). Objectives shared by vascular surgeons and IMPs include early identification of peripheral arterial disease (PAD), improved referral relationships, and reduction of health care costs. The approach to PAD by IMPs and identification of deficiencies that might contribute to suboptimal care form the basis for this report.
Methods: An anonymous survey was mailed to all IMPs (n = 843) in the central and southern parts of Illinois. Questions concerned IMP demographics, approach to diagnostic testing, referral patterns, perception of adequacy of education of PAD, and how often parts of the history and physical examination for PAD would be performed on the initial office visit of a hypothetical 65-year-old male with hypertension (each answer measured as 0%-25%, 25%-50%, 50%-75%, and 75%-100% of the time completed).
Results: There was a response from 360 IMPs: 230 IMPs (27.3%) returned the questionnaire, and 130 IMPs (15.4%) declined to participate. Practice locations for IMPs returning the questionnaire included rural (36%), suburban (22%), and urban (40%). Practice types included academic (7%), solo private (29%), group private (53%), and other (14%). A history of cardiac disease was obtained most of the time by 92% of IMPs (75%-100% answer category). Histories for pulmonary disease, diabetes mellitus, stroke, and smoking were obtained most of the time with similar frequencies (85%, 86%, 73%, and 96%, respectively). In contrast, only 37% obtained a history for claudication, and 26% obtained a history for foot ulceration 75% to 100% of the time ($P < .05$, all comparisons). Examination of the heart (95%) and lungs (96%) occurred most of the time (75%-100% answer category) compared with each part of the pulse examination (range, 34%-60%; $P < .05$, all comparisons) and aortic aneurysm palpation (39%; $P < .05$). If pedal pulses were absent, examination by IMPs with Doppler scan and ankle-arm indices were mostly distributed in the 0% to 25% answer category (79% and 79%, respectively). After suspecting PAD, most IMPs obtained diagnostic tests first compared with specialist referral: carotid disease (91% vs 9%), aortic aneurysm (91% vs 9%), and lower extremity PAD (86% vs 14%). Initial referral patterns were made to vascular surgeons (49%), general surgeons (33%), cardiothoracic surgeons (13%), cardiologists (4%), and radiologists (1%). Most IMPs believed medical school (70%) and residency (73%) provided adequate training for PAD diagnosis.
Conclusions: Deficiencies may exist in the identification of PAD by IMPs that could adversely affect diagnosis, time to referral, health care costs, and ultimately, patient outcome. Improvements in medical school education and IMP training in the diagnosis of PAD are needed. (J Vasc Surg 2000;31:870-9.)

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Vascular surgeons who practice in the United States have traditionally been the primary specialists who care for atherosclerotic diseases of the aorta, carotid, and lower extremity arteries, herein defined as peripheral arterial disease (PAD). This is in contrast to other surgical specialties, such as cardiothoracic surgery or surgical oncology; these fields have complementary medical subspecialties devoted to nonoperative treatment. Although increasing in number, subspecialists practicing vascular medicine are limited to only a few academic centers, thereby obligating most vascular surgeons to be the "primary care specialists" for nonoperative PAD in addition to their more identified role as surgeon. A conundrum exists because vascular surgeons depend on primary care physicians, primarily internal medicine physicians (IMPs) with no special training in vascular medicine, for referral of nonoperative and operative PAD problems.

Few areas of disease so readily lend themselves to diagnosis solely on the basis of a careful history and physical examination as PAD. With risk factors now well defined for atherosclerosis, a systematic approach to the diagnosis of PAD, regardless of symptoms, can predict the location and severity in most patients. This is particularly true for lower extremity occlusive disease where presentation depends on the phase of progression that can occur over a wide spectrum. Approximately 10% of patients older than 70 years have claudication, and 50% to 70% of these patients perceive the discomfort as a normal part of aging, having never complained of this symptom to their doctors.[1-4] The prevalence of asymptomatic PAD has been shown to approach 25% of the general population between the ages of 55 and 74 years.[5,6] With 20% of the population predicted to be older than 65 years by the year 2020,[7] a concomitant increase in the prevalence of PAD will most likely be observed.

More emphasis is being placed on preventative care, early detection of disease, and promotion of health, in an effort to improve quality of life and curb rising health care costs. Vaccination programs, screening mammography, Papanicolaou tests, and bone density measurements are examples of primary prevention initiatives. Although some progress has been made in the prevention of myocardial infarction and stroke, early detection and preventative strategies for atherosclerotic PAD are underdeveloped. Given the prevalence of PAD in the geriatric population and the ability to detect asymptomatic and symptomatic PAD by history and physical examination, early detection may lead to improved risk factor modification and follow-up for mild PAD and earlier operative intervention for severe PAD. To define the current approach to PAD before vascular surgery referral, we surveyed IMPs in central and southern Illinois. The identification of deficiencies that might contribute to suboptimal care before referral forms the basis of this report.

METHODS

Study cohort. The population designated for study consisted of all IMPs in central and southern Illinois. The IMPs were defined as physicians who indicated they practiced internal medicine. Physicians who completed more specialty training after finishing an internal medicine residency were included in the study if they specifically indicated that they also continued to practice internal medicine. General and family practitioners, as well as physicians solely practicing a specific specialty other than internal medicine, were excluded from the study.

The names and office addresses of IMPs were obtained from a database (software: NOMAD; Gores Technology Group, Los Angeles, Calif), maintained, and updated weekly by the Clinical Marketing Department of Southern Illinois University Physician and Surgeon's, Inc. The database contains all IMPs who practice south of Interstate 80, thereby eliminating all IMPs in northern Illinois, Chicago, and most of the Chicago suburbs (Fig 1).

Survey instrument. A pilot study was conducted by distributing a two-page questionnaire to five IMPs on the faculty of Southern Illinois University School of Medicine. After feedback and modification, all IMPs in central and southern Illinois were mailed the two-page questionnaire, which was designed to be answered anonymously. Included with the questionnaire was a postcard that we requested be returned separately to the study site. The information on the postcard included the IMP's name as well as the IMP's choice to return the survey or to not participate in the study. This was done to avoid duplication with subsequent mailings.

Between September 1, 1998, and March 1, 1999, three separate mailings of the questionnaire with postcard were performed. Subsequent mailings were only sent to IMPs that did not return a postcard. Those IMPs that indicated by postcard no desire to participate in the study were not included in subsequent mailings.

The questionnaire was divided into four parts, including IMP demographics, a case presentation,

Fig 1. The shaded area represents that portion of Illinois in which all IMPs were included in a database that was used for mailing the survey. All of Illinois south of Interstate 80 was included.

diagnostic testing and referral patterns, and perception of adequacy of PAD education. Demographic information included IMP age, sex, hours worked, practice setting, practice type, usual patient population, type of residency training, and years of residency training. The IMPs were asked to indicate their medical specialty to reconfirm the validity of the survey. Those physicians who indicated a different specialty were excluded from the study. Additional questions included whether IMPs had easy office access to a portable Doppler ultrasound scanning machine and whether the facility with which they were associated had an accredited vascular laboratory (Intersocietal Commission for the Accreditation of Vascular Laboratories).

The case presentation consisted of 21 questions about the medical history and physical examination for a "first time office evaluation of a slightly obese 65-year-old male taking one medication for hypertension." Special emphasis was placed on questions pertinent to a peripheral vascular history and examination. Included were questions about how often a history would be taken for cardiac and pulmonary disease, diabetes mellitus, smoking, stroke or transient ischemic attack (TIA), claudication, and pain or ulceration in the feet. Questions about physical examination included how often the heart and lungs would be auscultated, the blood pressure would be checked in both arms, the abdomen would be examined with an additional question pertaining specifically to examination for an abdominal aortic aneurysm, the carotid arteries would be auscultated for bruit, the pulses would be palpated, a portable Doppler ultrasound scanning machine would be used if pedal pulses were absent, and an ankle / brachial index (ABI) would be obtained during the office visit if pedal pulses were absent. The IMPs were asked how often they would complete each part of the history and examination. Answers for each question were divided into four categories designated as 0% to 25%, 25% to 50%, 50% to 75%, and 75% to 100% of the time. The percentage of IMPs taking a history for cardiac disease and auscultation of the heart in the 75% to 100% categories was designated as the criterion standard to which other parts of the respective history and physical examination were compared.

Seven questions about diagnostic testing and referral patterns were included in the survey. The IMPs were asked how often they would obtain a carotid duplex scan if a carotid bruit were present in an asymptomatic patient. In addition, on discovering a problem associated with carotid disease, abdominal aortic aneurysm, or PAD of the lower extremity, IMPs were asked if they were more apt to refer to a specialist before noninvasive diagnostic tests or obtain noninvasive tests and then refer to a specialist. With regard to carotid duplex scanning and tests for lower extremity PAD, IMPs were asked whether they would obtain the desired studies in a radiology department or a vascular laboratory. The IMPs were also asked to what type of specialist they would refer a patient with a new problem related to PAD. Choices included vascular surgeon, general surgeon, cardiothoracic surgeon, cardiologist, or radiologist. Finally, IMPs were asked if their education in medical school and residency provided ample training in the diagnosis of PAD.

Statistical analysis. McNemar's test for correlated proportions was used to compare the relative frequency of how often different respective parts of the history and physical examination would be performed by IMPs with the criterion standard of a history of heart disease and auscultation of the heart in the 75% to 100% category. The answer categories of 0% to 25%, 25% to 50%, and 50% to 75% were consolidated to simplify the comparisons, that is, IMPs performing different parts of the history and physical examination less than 75% of the time. A χ^2 test of independence was used to examine whether any of the IMP demographic subgroups were less apt to

perform different parts of the history and physical examination 75% to 100% of the time. Results were considered statistically significant for *P* less than .05.

RESULTS

A total of 941 IMPs were sent one or more questionnaires. Returned information revealed 10 IMPs had retired, five IMPs had died, eight IMPs had relocated out of the region, 25 questionnaires were returned because of lack of forwarding address, and 50 physicians indicated they were not IMPs, which left 843 IMPs eligible to answer the survey. After three mailings, 360 IMPs (43%) responded, with 230 IMPs (27.3%) returning the questionnaire and 130 IMPs (15.4%) declining to participate. Six questionnaires were incomplete, and the information available in these questionnaires was included in the analysis. Table I shows demographic information for the 230 IMPs who returned the questionnaire. Sixty-nine percent of IMPs stated they had easy office access to a portable Doppler ultrasound scanning machine, and 57% stated the facility with which they were associated had an accredited vascular laboratory, whereas 13% did not know. The cumulative percent breakdown for how often different parts of the history and the physical examination would be performed on a "first time office evaluation of a slightly obese 65-year-old male taking one medication for hypertension" is shown in Figs 2 and 3.

Table I. Demographic information of 230 IMPs who answered the questionnaire

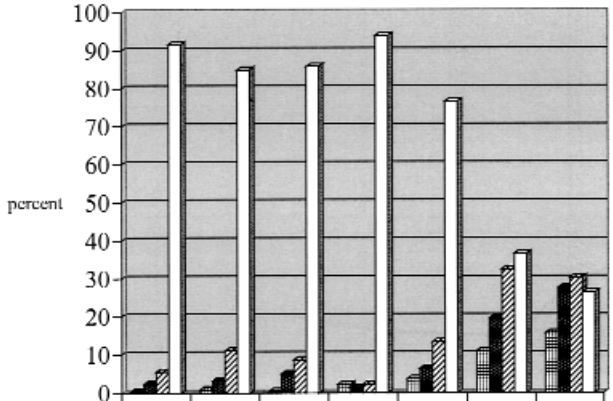
Physician characteristics	
Age	Mean: 46 y (range, 30-91 y)
Years of training	Mean: 4 y (range, 1-15 y)
Sex	
Male	84%
Female	16%
Hours worked	
Full-time	94%
Part-time	6%
Practice setting	
Rural	36%
Suburban	22%
Urban	40%
Practice type	
Academic	7%
Solo private	29%
Group private	50%
HMO	2%
Other	12%
Patient population	
Affluent	0.5%
Upper middle class	13%
Lower middle class	14%
Working poor	1%
Indigent	1%
Mixture	70%
Other	0.5%
Residency training	
University based	37%
Community based	63%

HMO, Health maintenance organization; *IMPs*, internal medicine physicians.

If an asymptomatic carotid bruit were present in the hypothetical patient, 13.6% of IMPs would send the patient for a carotid duplex 0% to 25% of the time, 7.9% of IMPs for 25% to 50% of the time, 17.3% of IMPs for 50% to 75% of the time, and 61.2% of IMPs for 75% to 100% of the time. After suspecting PAD, most IMPs would obtain noninvasive diagnostic tests before specialist referral compared with first referring to a specialist without obtaining noninvasive diagnostic tests: carotid disease (91% vs 9%, respectively), abdominal aortic aneurysm (91% vs 9%, respectively), and lower extremity PAD (86% vs 14%, respectively). When sending a patient for a carotid duplex scan study, 54% of IMPs would obtain the study in a vascular laboratory, 39% would obtain the study in the radiology department, and 7% did not know. When obtaining tests for lower extremity PAD, 62% of IMPs would send the patient to a vascular laboratory, 32% would send the patient to the radiology department, and 6% did not know. The breakdown of IMP first-time referral to a specialist for the treatment of a problem related to PAD was to vascular surgeons (49%), general surgeons (33%), cardiothoracic surgeons (13%), cardiologists (4%), and radiologists (1%). Seventy percent of IMPs believed medical school provided adequate training for PAD diagnosis, whereas 73% of IMPs believed residency provided adequate training.

Ninety-two percent of IMPs would take a history for cardiac disease 75% to 100% of the time, and 95% would auscultate the heart 75% to 100% of the time. With the use of these respective percentages as the criterion standard, the percentage of IMPs performing other parts of the history in the 75% to 100% category, except for smoking, was significantly less ($P < .001$). Similarly, the percent of IMPs performing all parts of the physical examination in the 75% to 100% category, except auscultation of the lungs, was significantly less ($P < .001$). Table II shows each of these comparisons.

Comparison of IMP demographic information with how often each different part of the history would be taken and the physical examination would be performed 75% to 100% of the time is shown in Tables III and IV, respectively. For history taking, only a history of stroke or TIA, claudication, and foot



Percent of the time history would be obtained	A	B	C	D	E	F	G
0 - 25%	0.5	0.9	0.5	2.3	3.7	11	15.7
25 - 50 %	2.3	3.2	5	1.4	6.4	19.7	27.6
50 - 75 %	5.5	11	8.7	2.3	13.3	32.6	30.4
75 - 100 %	91.7	84.9	85.8	94	76.6	36.7	26.3

Cumulative percent distribution of different parts of the history

X-axis labels
A: cardiac disease
B: pulmonary disease
C: diabetes mellitus
D: smoking
E: stroke/transient ischemic attack
F: claudication
G: foot ulcer or pain

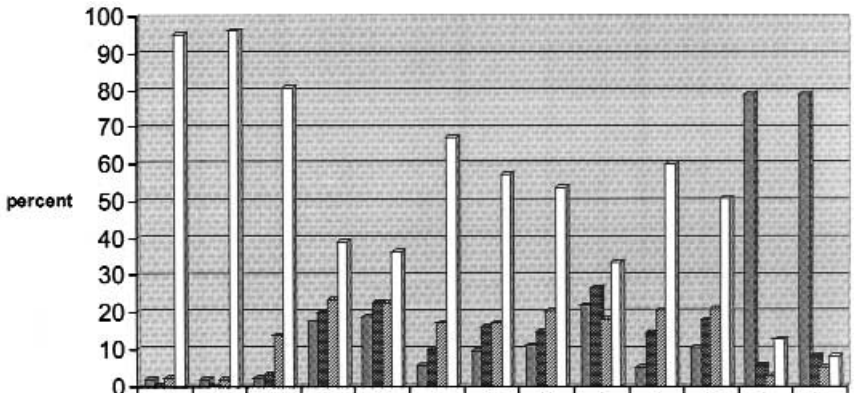
Fig 2. The bar chart and table represent the cumulative percent distribution of how often different parts of the history would be taken by IMPs.

ulcer or pain was associated with different types of IMP characteristics that contributed to IMPs who were less likely to take a history 75% to 100% of the time. These characteristics included IMPs younger than 45 years, rural practice setting, community-based residency training, less than 4 years of residency training, no portable Doppler ultrasound scanning machine available in the office, and no accredited vascular laboratory in the facility with which the IMP is associated. When we compared each IMP demographic characteristic with how often each part of the physical examination would be performed 75% to 100% of the time, IMPs younger than 45 years, female sex, rural practice setting, no portable Doppler ultrasound scanning machine available in the office, and no accredited vascular laboratory in the facility with which the IMP is associated were associated with certain parts of the physical examination being performed less than 75% of the time (Table IV). Seven different parts of the physical examination would be performed less than 75% to 100% of the time if no portable continuous-wave Doppler scanning machine was available in the office.

DISCUSSION

Symptomatic and major occult PAD from atherosclerosis has been estimated to affect 10% to 17% of individuals older than 65 years in the Western world.[5,8-13] Despite the magnitude of the problem, physician awareness of the signs and symptoms of PAD as compared with coronary artery disease remains questionable.[14-16] In the United States, training for the diagnosis and treatment of PAD is primarily relegated to the specialty of vascular surgery. Most new patients sent to vascular surgeons are referred by IMPs who represent most primary care physicians providing continuity of care to elderly patients.

The purpose of this study was to define the approach to the diagnosis of PAD by IMPs before vascular surgery referral. Of the 843 IMPs in central and southern Illinois who were mailed a two-page anonymous survey, 27.3% returned the survey. An



Percent of the time physical examination would be performed	A	B	C	D	E	F	G	H	I	J	K	L	M
0 - 25 %	1.8	1.8	2.3	17.4	18.8	5.5	9.6	11	21.9	5.1	10.3	79.1	79.1
25 - 50 %	0.5	0	3.2	20.2	22.5	10.1	16.1	14.7	26.5	14.4	17.8	5.6	7.9
50 - 75 %	2.3	1.8	13.8	23.4	22.5	17	17	20.6	18.1	20.5	21	2.8	5.1
75 - 100 %	95.4	96.3	80.7	39	36.2	67.4	57.3	53.7	33.5	60	50.9	12.6	7.9

Cumulative percent distribution of different parts of the physical examination

X-axis labels

A: heart auscultation
B: lung auscultation
C: abdominal exam
D: abdominal exam specifically for aortic aneurysm
E: blood pressure in both arms
F: carotid bruit auscultation
G: carotid pulse palpation
H: radial pulse palpation
I: femoral pulse palpation
J: dorsal pedal pulse palpation
K: posterior tibial pulse palpation
L: listen with a Doppler machine in office if pedal pulses are absent
M: perform ankle-brachial index in office if pedal pulses are absent

Fig 3. The bar chart and table represent the cumulative percent distribution of how often different parts of the physical examination would be performed by IMPs.

additional 15.4% declined to participate, whereas the remaining 57.3% did not respond. Demographic information regarding practice setting, practice type, and residency training were well distributed among IMPs, whereas most IMPs were male, worked full-time, were in private practice, and had a mixture of patients from different socioeconomic backgrounds (Table I). Demographic information on IMPs who declined to participate or did not respond was not available except for sex distribution among the three groups. Sixteen percent of IMPs returning questionnaires were female, which was similar to 16.5% of those declining to participate and 16% of those not responding.

For the case presented in the questionnaire concerning a first time visit of a slightly obese 65-year-old man taking one antihypertensive medication, 92% of IMPs stated they would take a history for cardiac disease, and 95% would auscultate the heart 75% to 100% of the time. With the use of these respective percentages in the 75% to 100% category as the criterion standard, IMPs overall did poorly in their history and examination for PAD (Figs 1 and 2, Table II). Of the three types of PAD questioned for in the case presentation (cerebrovascular disease, abdominal aortic aneurysm, and lower extremity arterial occlusive disease), IMPs were most diligent in checking for cerebrovascular disease. Seventy-six percent would take a history of stroke and/or TIA, 57% would palpate for a carotid pulse, and 67% would auscultate for carotid bruit 75% to 100% of the time. Only 39% of IMPs would palpate specifically for an abdominal aortic aneurysm 75% to 100% of the time, which was of concern. With the exception of dorsal pedal pulse palpation (60% of IMPs), all other areas of the history and physical examina-

Table II. Comparison of how often IMPs would perform different parts of the history and physical examination 75% to 100% of the time compared with the criterion standard of a history of cardiac disease (92% of IMPs in the 75%-100% category) and auscultation of the heart (95% of IMPs in the 75%-100% category)

History of	*Percent in 75%-100% category*	P *value*
Pulmonary disease	84.9	< .001
Diabetes mellitus	85.8	< .001
Smoking	94.0	NS
Stroke / TIA	76.6	< .001
Claudication	36.7	< .001
Foot ulcer / pain	26.3	< .001
Physical examination of		
Lungs	96.3	NS
Abdomen	80.7	< .001
Abdomen for aortic aneurysm	39.0	< .001
Blood pressure—both arms	36.2	< .001
Carotid bruit	67.4	< .001
Carotid pulse	57.3	< .001
Radial pulse	53.7	< .001
Femoral pulse	33.5	< .001
Dorsal pedal pulse	60.0	< .001
Posterior tibial pulse	50.9	< .001
Doppler scan machine in office if pedal pulses absent	12.6	< .001
ABI in office if pedal pulses absent	7.9	< .001

ABI, Ankle / brachial index; *IMPs,* internal medicine physicians; *NS,* not significant; *TIA,* transient ischemic attack.

tion concerning PAD were performed by less than 54% of IMPs in the 75% to 100% category.

Despite the low percentages of IMPs answering in the 75% to 100% category for PAD-related questions, a moderate proportion answered in the 25% to 50% and 50% to 75% of the time categories (Figs 2 and 3). This may indicate that IMPs are aware of PAD but do not routinely assess for it in their examination. The case presented in the survey was purposely meant to be ambiguous because symptomatic and major occult vascular disease may not always be apparent to the patient and depends on a physician's directed history and physical examination. It is not known whether the patient presented in the survey has ever had a TIA, feels a pulsating mass in his abdomen, or has claudication. Similarly, it is not known whether the patient has a carotid bruit, a pulsatile abdominal mass, or absent lower extremity pulses with a neurotrophic ulcer unless a directed history and physical examination are performed. Perhaps more IMPs would have answered in the 75% to 100% category if an older patient with more atherosclerotic risk factors were presented as the index case. Nevertheless, this does not negate the fact that PAD can be seen at different stages, and the diagnosis may depend on careful history and physical examination. The purpose of the survey was not to determine whether early identification of PAD, be it symptomatic or asymptomatic, affects patient outcome. Rather, the purpose was to define the diagnostic approach to PAD by IMPs.

If pedal pulses were absent in the case presented, 79% of IMPs would use a portable Doppler ultrasound scanning machine, and 79% would check ABIs only 0% to 25% of the time (Fig 3). Sixty-nine percent reported that they had easy office access to a portable Doppler scanning machine, whereas only 57% reported that the facility with which they were associated had an accredited vascular laboratory. Intuitively from these data the conclusion that IMPs should use a portable Doppler ultrasound scanning machine and perform ABIs if pedal pulses are absent may be premature. Although vascular surgeons may view the measurement of ABIs as a quick objective test that is part of the routine physical examination in the absence of pulses,[17] IMPs do not have similar views. The reasons behind these views may be multifold and complex. The awareness by the IMP of the natural history of PAD, education and training background, cost / benefit issues, and optimal use of time in a busy clinic setting where up to 30 to 40 patients could be seen in one day may all play a role. Given these limitations, we realize that a comprehensive examination for PAD is not necessary in every patient. However, the addition of auscultation for carotid bruits, palpation for abdominal aortic aneurysm, and examination of the feet in an elderly patient with atherosclerotic risk factors does not seem unreasonable with regard to the extra time needed.

The survey did not ask the specific question as to whether IMPs would obtain ABIs in a vascular laboratory if pedal pulses were absent. In our medical community of Springfield, Ill, with a population of 110,000 and a referral base of 2 million, the hospital and physician fee for obtaining ABIs with single-level waveforms in a vascular laboratory is $267. In 1998, a total of 2565 of these tests were performed in two area vascular laboratories representing a total billing fee for one year of $684,855. Given that the test can be easily performed in the clinic setting at no cost and with minimal inconvenience to the patient, it may be reasonable to assess ways to educate IMPs as to how to perform ABIs and selectively use the test more often. Clearly from a cost stand-

Table III. IMP demographics and history taking: comparison of IMP demographics with how often different parts of the history would be performed 75%-100% of the time for a "first time office evaluation of a slightly obese 65-year-old male taking one medication for hypertension"*

	How often IMPs would take a history of						
	Cardiac disease	*Pulmonary disease*	*Diabetes mellitus*	*Smoking*	*Stroke/ TIA*	*Claudication*	*Foot ulcer/ pain*
Age	NS	NS	NS	NS	NS	.005†	.001†
Sex	NS	NS	NS	NS	NS	NS	NS
Practice setting	NS	NS	NS	NS	.032‡	NS	.017‡
Residency training	NS	NS	NS	NS	NS	NS	.041§
Years training	NS	NS	NS	NS	.043‖	.050‖	.001‖
Office Doppler scan	NS	NS	NS	NS	.011¶	NS	NS
Accredited vascular laboratory	NS	NS	NS	NS	NS	.022#	NS

*Numbers entered represent *P* values ≤ .05.
†IMPs significantly less apt to take a respective history 75% to 100% of the time if age < 45 years.
‡IMPs significantly less apt to take a respective history 75% to 100% of the time if practicing in a rural setting.
§IMPs significantly less apt to take a respective history 75% to 100% of the time if trained in a community-based residency program.
‖IMPs significantly less apt to take a respective history 75% to 100% of the time if < 4 years residency training completed.
¶IMPs significantly less apt to take a respective history 75% to 100% of the time if no portable continuous-wave Doppler scanning machine is available.
#IMPs significantly less apt to take a respective history 75% to 100% of the time if facility with which IMP is associated does not have an accredited vascular laboratory.
IMP, Internal medicine physician; *NS,* not significant; *TIA,* transient ischemic attack.

Table IV. IMP demographics and physical examination: comparison of IMP demographics with how often different parts of the physical examination would be performed 75% to 100% of the time for a "first time office evaluation of a slightly obese 65-year-old male taking one medication for hypertension"*

	How often IMPs would perform physical examination of												
	BP/both arms	*Heart*	*Lungs*	*Abdomen*	*Abdomen AAA*	*Carotid bruit*	*Carotid pulse*	*Radial pulse*	*Femoral pulse*	*DP pulse*	*PT pulse*	*Doppler scan†*	*ABI‡*
Age	NS	.024§	NS	NS	NS	NS	.029§	NS	NS	NS	NS	NS	NS
Sex	NS	NS	NS	NS	.047‖	NS	.050‖	NS	NS	NS	NS	NS	NS
Practice setting	NS	NS	NS	NS	NS	NS	NS	NS	NS	.008¶	.024¶	NS	NS
Residency training	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Years training	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Office Doppler scan	NS	NS	NS	.014#	.036#	NS	NS	NS	.003#	.017#	.028#	.001#	.004#
Accredited vascular laboratory	NS	NS	NS	NS	NS	NS	NS	.013**	NS	.011**	NS	NS	NS

*Numbers entered represent *P* values ≤ .05.
†Use portable continuous-wave Doppler scan if no pedal pulses palpable.
‡Check ABI if no pedal pulses palpable.
§IMPs significantly less apt to perform respective physical examination 75% to 100% of the time if age < 45 years.
‖IMPs significantly less apt to perform respective physical examination 75% to 100% of the time if female.
¶IMPs significantly less apt to perform respective physical examination 75% to 100% of the time if practicing in a rural setting.
#IMPs significantly less apt to perform respective physical examination 75% to 100% of the time if no office portable continuous-wave Doppler scanning machine is available.
**IMPs significantly less apt to perform respective physical examination 75% to 100% of the time if facility with which IMP is associated does not have an accredited vascular laboratory.
AAA, Abdominal aortic aneurysm; *ABI,* ankle / brachial index; *BP,* blood pressure; *DP,* dorsal pedal; *IMP,* internal medicine physician; *NS,* not significant; *PT,* posterior tibial.

point, reductions could be made, while at the same time, there could be an increase in the awareness of PAD in the primary care setting.

After identifying a new problem associated with carotid artery disease, abdominal aortic aneurysm, or lower extremity arterial occlusive disease, IMPs were asked whether they would obtain noninvasive diagnostic tests before referring to a specialist or first refer to a specialist. Most IMPs stated they would first obtain noninvasive diagnostic tests. Although con-

clusions as to what tests would be obtained cannot be made, the purpose of these questions was to determine the general practice habits of IMPs before referral. Clearly, most IMPs are comfortable with ordering more noninvasive diagnostic tests for the diagnosis of PAD without the initial input of a specialist. Previous studies have shown that primary care physicians are more likely to order unnecessary tests as compared with cardiologists when comparing these practice patterns with the diagnostic workup for coronary artery disease.[17,18] Furthermore, studies have shown that knowledge, treatment, and outcome regarding acute myocardial infarction, congestive heart failure, and unstable angina are improved with specialist versus generalist care.[19-26]

Most of central and southern Illinois is rural with farming as the predominant part of the economy. The results of this survey may not be indicative of practice patterns in larger metropolitan areas. When a carotid duplex scan study or tests for lower extremity arterial occlusive disease are obtained, 54% and 62% of IMPs, respectively, would obtain these tests in a vascular laboratory. These percentages are similar to the 57% of IMPs who stated the facility with which they were associated had an accredited vascular laboratory. Furthermore, 51% of IMPs would refer a patient for the first time to a specialist other than a vascular surgeon. These patterns are more likely regional as opposed to universal. Larger studies examining primary care physicians' role in the diagnosis of PAD are needed.

Other limitations of this study should be acknowledged. The survey return rate of 27% was modest and may present bias into the study. Complicating this further was that 130 (36%) of 360 responding IMPs refused to participate. Whether this better validates the study is unclear. Perhaps those physicians who refused to participate were not IMPs or believed their practice was not applicable to the need for PAD diagnosis. More important is whether the responders are a representative sample of the entire group surveyed. Sex and geographic distribution among responders, nonresponders, and those physicians who refused to participate was evenly proportioned among the three groups. This provides some support to obtaining a representative sample, but more demographic data on physicians not returning the survey would be desirable to make this conclusion. Certainly, a larger response rate would provide for less bias, and therefore a different method, such as phone or personal interview, may be needed. After three mailings, we were concerned that only 27.3% of IMPs completed and returned the two-page survey.

Another factor not addressed in this survey was the proportion of patients seen by IMPs who were enrolled in managed care insurance programs. Without this knowledge, it may be difficult to project the results of this study to other parts of the United States where that percentage may vary greatly. One recent study showed that primary care physicians believed preventative care was improved when they were designated as a gatekeeper for a specific managed care insurance plan.[27]

Most IMPs believed medical school and residency provided them with ample training in the diagnosis of PAD. This perception contradicts the results of the survey showing that IMPs do not integrate enough of the essential parts of the history and physical examination to diagnose PAD. Perhaps a more important question for IMPs that was not addressed in the survey is their perception of the importance of performing a complete vascular examination.

The chronic nature of PAD and the associated mortality, albeit mostly from coronary artery disease, have been compared with malignancy.[28] Given this comparison, this disparity in IMP perception may play a role in the decreased "lead time" and increased "lag time" when diagnosing and treating PAD. Improvements in IMP education and awareness of PAD may provide for earlier diagnosis (increasing the lead time) and shorter time to treatment (decreasing the lag time), which may in turn provide for better outcomes. Certainly for symptomatic PAD, this assumption may be intuitively sound. For patients with asymptomatic PAD, improvement in outcome from earlier diagnosis remains unclear. It must be emphasized that the study does not specifically address patient outcome, but rather makes a first attempt to establish a baseline of the diagnostic approach to PAD before vascular surgery referral. Initiating efforts to increase IMP awareness of PAD in the United States may represent a challenge that deserves more participation by vascular surgeons.

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